MAGNETIC BLADE ATTACHMENT IN AN ICE CONDITIONING MACHINE

This invention is in the field of ice conditioners and ice resurfacing machines, and in particular an apparatus for connecting an ice-shaving blade to an ice conditioning or re-surfacing machine.

BACKGROUND

Ice conditioning and re-surfacing machines, such as the Zamboni® and Olympia™ ice conditioning machines, are used in skating arenas to smooth ice surfaces by shaving off a thin layer of the ice. Commonly as well these machines also incorporate tanks and mechanisms for then flooding the ice with a layer of liquid water on the shaved ice surface. The newly added water freezes to produce a substantially smooth surface, and repairs imperfections in the ice caused by the action of skate blades. Such ice conditioning machine are fairly large vehicles with a seat for the operator when used on skating ice surfaces, but are also made in smaller walk-behind models, generally without the flooding capability, for use in curling rinks.

In order to shave the ice prior to flooding, ice conditioning machines incorporate into their design some form of ice blade. The ice blade removes rough spots in the ice surface to produce a substantially uniform and level surface upon which fresh water is applied,

cleans foreign materials off the surface, and shaves off a layer of ice to prevent the ice from getting too thick.

The attachment of the ice blade to the machine is problematic as the ice blade must be firmly attached to minimize flexing of the blade, and must be level so that when operative the ice blade removes an ice layer of uniform thickness. Conventionally such ice blades are attached to the resurfacing machine by means of conventional nut and bolt methodologies. As ice blades can be of significant length (up to 8 ft. long) a number of bolts, as many as 10, are required to properly hold the ice blade firmly in place.

As a result, installing, changing or leveling the heavy ice blades is a time-consuming and cumbersome process. Since the ice blades are very sharp, handling them during removal and installation is also potentially hazardous.

SUMMARY OF THE INVENTION:

It is an object of the present invention to provide an apparatus for attaching ice blades used on ice conditioning machines that overcomes disadvantages of the prior art. It is a further object of the present invention to provide such an apparatus that provides an apparatus that uses magnets to attach the ice blade to the ice conditioning machine.

Using magnetic attachment allows the ice blade to be rapidly attached and removed, without the need to manually thread and tighten a large number of nuts and bolts as is currently done with existing prior art ice blades. The use of an electromagnetic means of attachment has the further advantage of allowing the magnetic attachment to be released or engaged as desired, as well as allowing the force of the magnetic attachment to be varied.

The invention provides, in one embodiment, an ice conditioning apparatus comprising an ice conditioning machine mounted on wheels for movement along an ice surface in an operating travel direction. A blade bar is mounted on the ice conditioning machine. An ice blade defines a cutting edge on a lower front edge thereof. A plurality of magnets are attached to the blade bar and are operative to exert a magnetic attraction on the ice blade and to hold the ice blade against the blade bar in an operating position such that the ice blade is oriented substantially parallel to the ice surface. The blade bar and ice blade define blade guides operative to prevent sliding movement of the ice blade out of the operating position when the cutting edge engages the ice surface in the operating travel direction. A blade height control is operative to move the blade bar with respect to the wheels to move the ice blade up and down.

In a second embodiment the invention provides a method of attaching an ice blade to an ice conditioning machine mounted on wheels for movement along an ice surface in an operating travel direction. The method comprises attaching a blade bar to the ice

conditioning machine; attaching a plurality of magnets to the blade bar; bringing the ice blade and blade bar together such that the ice is magnetically held against the blade bar in an operating position oriented substantially parallel to the ice surface; and preventing sliding movement of the ice blade out of the operating position by providing blade guides.

The blade guides are operative to ensure proper placement of the ice blade on the ice conditioning machine, and can be configured to conveniently and properly position the ice blade. Cradles can be provided to facilitate removal and installation of the ice blades.

DESCRIPTION OF THE DRAWINGS:

While the invention is claimed in the concluding portions thereof, preferred embodiments are provided in the accompanying detailed description, which may best be understood in conjunction with the accompanying diagram where like parts are labeled with like numbers, and where:

Fig. 1 is a side view of an apparatus of the invention;

Fig. 2 is a top view of the blade bar and attached ice blade;

Fig. 3 is a cross-sectional view along line 3 - 3 in Fig. 2;

Fig. 4 is a schematic sectional view of an ice blade and blade bar embodying one configuration of blade guides;

Fig. 5 is a schematic sectional view of an ice blade and blade bar embodying an alternate configuration of blade guides operative to prevent movement of the ice blade away from the blade bar;

Fig. 6 is a bottom view of the blade bar of Fig. 5;

Fig. 7 is a top view of the ice blade of Fig. 5;

Fig. 8 is a top view of a blade recess of the ice blade of Fig. 7;

Fig. 9 is a schematic sectional side view of a cradle and ice blade;

Fig. 10 is a partial top view of the cradle and ice blade of Fig. 9.

DETAILED DESCRIPTION OF THE ILLUSTRATED EMBODIMENTS:

Figs. 1 - 3 illustrate an embodiment of the present invention, an ice conditioning apparatus 1 comprising an ice conditioning machine 2 mounted on wheels 4 for

movement along an ice surface 5 in an operating travel direction T. The illustrated embodiment is the type commonly used in skating ice surfaces, however such ice conditioning machine are also known in smaller walk-behind models for use in curling rinks, and the description below will apply to such smaller ice conditioning machines as well.

A blade bar 6 is attached to a rear end of the ice conditioning machine 2. A plurality of magnets 8 is attached to the blade bar 6 and exert a magnetic attraction on an ice blade 10 and to hold the ice blade 10 against the blade bar 6 in an operating position OP such that the ice blade 10 is oriented substantially parallel to the ice surface 5. The ice blade 10 defines a cutting edge 12 on a lower front edge thereof that is operative to shave a thin layer of ice from the ice surface 5.

A blade height control 14 is operative to move the blade bar 6 with respect to the wheels 4 to move the ice blade 10 up and down. The ice blade 10 thus can be moved up to provide clearance for transport, as well as up and down to vary a thickness of the layer of ice shaved off the ice surface by the ice blade 10.

The blade bar 6 and ice blade 12 define blade guides 20 operative to prevent sliding movement of the ice blade 10 out of the operating position OP when the cutting edge 12 engages the ice surface 5 in the operating travel direction T. In the embodiment of Figs. 1 - 3 the blade guides 20 are provided by a ridge 22 along a rear bottom portion of the

blade bar 6 and the rear edge 24 of the ice blade 10. Thus as the ice blade 10 engages the ice surface 5 when moving in the operating travel direction T, a rearward force is exerted on the ice blade 10 that will tend to move it out of the illustrated operating position OP. This force is resisted since the rear edge 24 of the ice blade 10 bears against the ridge 22, and movement away from the operating position OP is prevented.

An alternate configuration of blade guides 20 and magnets 8 is schematically illustrated in Fig. 4 where the blade guides 20 comprise a plurality of conical tapered pegs 32 extending from the ice blade 10 into corresponding conical tapered recesses 34 in the blade bar 6. Such a configuration allows for some misalignment. As the blade bar 6 is moved downward onto the ice blade 10 and the tapered pegs 32 move into the tapered recesses 34, a lateral force is exerted by a tapered side of the pegs 32 against a tapered side of the recesses 34 to move the ice blade 10 laterally. When the tapered pegs 32 are seated in the tapered recesses 34 the ice blade 10 will be in the operating position held vertically by the magnets 8 and prevented from sliding out of position by the blade guides 20 comprising the tapered pegs 32 seated in the tapered recesses 34.

In order to more securely fasten the ice blade 10 to the blade bar 6 the blade guides 20 can be further operative to prevent movement of the ice blade 10 away from the blade bar 6 when the ice blade 10 is in the operating position OP. In the embodiment illustrated in Figs. 5 - 8 the blade guides 20 comprise blade pegs 40, extending down from the blade bar 6, and blade recesses 42, defined by an upper portion of the ice blade 10. The blade

pegs 40 comprise a head 44 on distal ends thereof and the heads 44 have a width WH greater than the width WP of the pegs 42 , as illustrated in Fig. 8.

The blade recesses 42 are elongated in the operating travel direction T and each recess 42 has a width WH greater than the head and comprises an open portion 46 at one end thereof larger than the head 44, such that the head 44 can be inserted in the open portion 46. A covered portion 48 comprises a slot 50 extending laterally forward from the open portion 46. The covered portion 48 is configured to allow the blade peg 40 to pass along the slot 50, and allow the head 44 to pass along the blade recess 42 under the slot 50, and prevent the head 44 from passing through the slot 50. Thus, as best seen in Fig. 5, to attach the ice blade 10, the blade bar 6 is lowered to position the peg 40 and head 44 in the open portion 46 of the blade recess 42. The pegs 40 and recesses 42 are configured such that when the top surface of the ice blade 10 is against the bottom surface of the blade bar 6, the head 44 is just below the slot 50 on the covered portion 48.

Thus when the ice blade 10 is against the blade bar 6, the magnets 8 hold the ice blade 10 and blade bar 6 together, but will allow sliding movement between them. The blade bar 6 is moved forward with respect to the ice blade 10, and the blade peg 40 moves along the slot 50, and the head 44 moves along the recess 42 just under the slot 50 into the position illustrated schematically in Fig. 8. In the position of Fig. 8, movement of the ice blade away from the blade bar 6 is prevented by the head 44 bearing against the bottom of the

slot 50. Thus the ice blade is maintained in the operating position by the magnets 8 and the blade guides 20 embodied in the head 44 and the slot 50.

In the illustrated embodiment, the slot 50 is tapered and has a proximate width at a first end 52 adjacent to the open portion 46 that is greater than the width PW of the blade peg 40, and a distal width at an opposite second end 54 that is substantially equal to the width of the blade peg 40. The open portion 46 is also somewhat larger than the head 40. Thus less precision is required in positioning the blade bar 6 with respect to the ice blade 10, but as the blade bar 6 is moved forward in operating travel direction T the tapered slots 50 bear against the blade pegs 40 and force them into the proper position at the distal ends 54 of the slots 50, where the width of the slots 50 is substantially equal to the width WP of the blade pegs 40.

To facilitate holding the ice blade 10 in a fixed position so that the blade bar 6, mounted on the ice conditioning machine 2, can be moved forward with respect to the ice blade 10, a cradle 60 can be provided. One embodiment of such a cradle 60 is illustrated in Figs. 9 and 10. The cradle 60 is attached to the floor, and a top side of the cradle 60 is operative to engage the ice blade 10 and maintain the ice blade 10 in an installation position. The illustrated embodiment of the cradle 60 holds two ice blades, and the rear ice blade 10 is shown in the installation position IP.

The illustrated embodiment of the cradle 60 comprises cradle pegs 62 extending upward from the cradle 60 into corresponding cradle recesses 64 defined by a lower portion of the ice blade 10, as illustrated in Fig. 9. The cradle recesses 64 are offset with respect to the blade recesses 42, as illustrated in Fig. 10, and the cradle pegs 62 are mounted to corresponding locations on the cradle 60. The ice blade 10 is manually placed on the cradle so that the heads 66 of the cradle pegs 62 enter the open portions 68 of the cradle recesses 64, and then moved rearward with respect to the cradle 60 so that the cradle pegs 62 move to the distal ends 72 of the slots 70. The cradle pegs 60 and the cradle recesses 64 are configured similar to the blade pegs 40 and blade recesses 42, such that the heads 66 of the cradle pegs 62 engage tapered slots 70 covering a portion of the cradle recesses 64. The configuration is the same as that illustrated in Fig. 8 for the blade pegs and recesses 40, 42. Similar to the case with the blade pegs 40 and blade recesses 42, the ice blade 10 is maintained in the installation position IP by the heads 66 bearing against the slots 70.

Then the ice conditioning machine 2 can then be driven over the cradle 60 and as in Fig. 5 the blade bar 6 can be lowered to position the heads 44 of the blade pegs 40 in the open portions 46 of the blade recesses 42. The bottom of the blade bar 6 lies against the top of the ice blade 10 and the magnets 8 exert a force holding the two together. When the ice conditioning machine 2 is then moved forward, sliding the blade bar 6 with respect to the ice blade 10, to engage the blade pegs 40 in the slots 50, the ice blade 10 moves forward with respect to the cradle 60 until the back wall 80 of the cradle recess 64 contacts the

head 66 of the cradle pegs 62. The ice blade is prevented from moving farther ahead and so the blade pegs 40 move into the distal ends of the slots 50 and thus into the operating position OP. At that time the blade height control 14 is operated to raise the blade bar 6 and ice blade 10 up so that the cradle peg heads 66 clear the cradle recesses 64, and the ice conditioning machine 2 is ready to work.

To remove the ice blade 10, the process is reversed by lowering the ice blade 10 into engagement with the cradle pegs 62, and moving the ice conditioning machine 2 rearward to engage the cradle pegs in the cradle recesses 64 and slots 70, while at the same time moving the blade pegs 40 into the open portion 46 of the blade recesses 42. The blade bar 6 can then be raised, breaking the magnetic bond, until clear of the ice blade 10. The ice conditioning machine 2 can then be maneuvered to engage the second ice blade 10 mounted on a raised second set of cradle pegs 62 of the cradle 60 in a second installation position oriented substantially parallel to and in alignment with the first ice blade 10.

Wheel guides 76 are aligned with the cradle 60 to guide the ice conditioning machine 2 into proper alignment with the ice blade 10 such that the blade bar 6 can be lowered to position the heads 44 of the blade pegs 40 in the open portions 68 of the cradle recesses 64.

The magnets 8 can conveniently be electromagnets. An electrical power source can be incorporated into the ice conditioning machine 2 operative to supply electrical current to

the electromagnets, and a magnet control will be operative to control the electrical current passing from the electrical power source through the electromagnets, and to close off the electrical power to the electromagnets such that the magnetic attraction between the blade bar 6 and the ice blade 10 is substantially released.

The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous changes and modifications will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly, all such suitable changes or modifications in structure or operation which may be resorted to are intended to fall within the scope of the claimed invention.